FORM PTO-1390 (Modified) (REV 11-98) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

IC03 Rec'd PCT/GTO 11 JUN 2001

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER	U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR
112740-170	09/857926

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE99/03808	01 December 1999	09 December 1998

TITLE OF INVENTION

METHOD FOR OPERATING INTERFACE MODULES IN AN ATM COMMUNICATIONS DEVICE

APPLICANT(S) FOR DO/EO/US

Joerg Koepp et al.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
   a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ A copy of the International Search Report (PCT/ISA/210).
8. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
9. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☒ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 20 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☒ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☒ Certificate of Mailing by Express Mail
20. ☒ Other items or information:

Submission of Drawings Figure 1 on one sheet

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR	INTERNATIONAL APPLICATION NO.	IC03 Rec'd PCT/PTO 11 JUN 2001 ATTORNEY'S DOCKET NUMBER
09/857926	PCT/DE99/03808	112740-170

21. The following fees are submitted:.	CALCULATIONS PTO USE ONLY
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :	
☐ Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2) paid to USPTO and International Search Report not prepared by the EPO or JPO $1,000.00	
☒ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but Internation Search Report prepared by the EPO or JPO $860.00	
☐ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO $710.00	
☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) $690.00	
☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) $100.00	
ENTER APPROPRIATE BASIC FEE AMOUNT =	$860.00
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).	$0.00

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total claims	3 - 20 =	0	x $18.00	$0.00
Independent claims	1 - 3 =	0	x $80.00	$0.00
Multiple Dependent Claims **(check if applicable)**.			☐	$0.00

TOTAL OF ABOVE CALCULATIONS =	$860.00
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) **(check if applicable)**. ☐	$0.00
SUBTOTAL =	$860.00
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)). +	$0.00
TOTAL NATIONAL FEE =	$860.00
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) **(check if applicable).** ☐	$0.00
TOTAL FEES ENCLOSED =	$860.00
Amount to be: refunded	$
charged	$

☒ A check in the amount of **$860.00** to cover the above fees is enclosed.

☐ Please charge my Deposit Account No. in the amount of to cover the above fees.

A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **02-1818** A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

William E. Vaughan (Reg. No. 39,056))
Bell, Boyd & Lloyd LLC
P.O. Box 1135
Chicago, Illinois 60690

SIGNATURE

William E. Vaughan
NAME

39, 056
REGISTRATION NUMBER

June 11, 2001
DATE

BOX PCT

IN THE UNITED STATES ELECTED/DESIGNATED OFFICE
OF THE UNITED STATES PATENT AND TRADEMARK OFFICE
UNDER THE PATENT COOPERATION TREATY-CHAPTER II

PRELIMINARY AMENDMENT

APPLICANTS: Joerg Koepp et al. DOCKET NO: 112740-170
SERIAL NO: GROUP ART UNIT:
EXAMINER:
INTERNATIONAL APPLICATION NO: PCT/DE99/03808
INTERNATIONAL FILING DATE: 01 December 1999
INVENTION: METHOD FOR OPERATING INTERFACE MODULES IN AN ATM COMMUNICATIONS DEVICE

Assistant Commissioner for Patents,
Washington, D.C. 20231

Sir:

Please amend the above-identified International Application before entry into the National stage before the U.S. Patent and Trademark Office under 35 U.S.C. §371 as follows:

In the Specification:

Please replace the Specification of the present application, including the Abstract, with the following Substitute Specification:

SPECIFICATION

TITLE

METHOD FOR OPERATING INTERFACE MODULES IN AN ATM COMMUNICATIONS DEVICE

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a method for operating interface modules, which can be specified as active and/or redundant, in an ATM communications device,

in which the interface modules, which can be specified as active and/or redundant, are connected to a central control unit.

Description of the Prior Art

In communications devices, in particular communications devices that operate using the asynchronous transfer mode, virtual connections are often established, maintained and terminated via interface modules with the aid of a central control unit. The central control unit is used here, in particular, to transmit control commands to establish and clear virtual connections to the interface modules.

In order to ensure disruption-free operation and to enable rectification of errors in an active interface module, redundant interface modules and/or redundant transmission paths are provided. If one interface module or transmission path fails, the communications link, in particular a virtual connection, is rerouted to a redundant interface module and/or transmission link. Depending on the level of fail-safety required for a communications device or transmission link, it is possible to provide different redundancy structures for the associated interface module. Examples of these are "1+1", "1:1" and "1:N" interface module redundancy, cf. in particular "IEEE Journal on Selected Areas in Communications", VOL. 15, No. 5, June 1997, pages 795 to 806.

With a "1+1" redundancy structure, two interface modules are operated in parallel in order for communication signal streams to be transmitted via them redundantly. Of these communication signal streams transmitted redundantly, only one is used for the further processing of the virtual connection.

With "1:1" interface module redundancy, only one of two interface modules is used as the active interface module, with a switchover being made to the remaining redundant interface module only if the active interface module fails.

With "1:N" interface module redundancy, one redundant interface module is additionally provided for a number N of interface modules. If an error occurs in one of the N interface modules, a switchover is then made to the redundant interface module instead.

With "1:N" interface module redundancy, a selector arrangement is usually connected between the interface modules and the external transmission lines; the selector can allocate the individual transmission lines to the N interface modules and the redundant interface module. It should be noted however that if a selector arrangement fails, or in the event of the selector arrangement being consequently exchanged, all transmission lines connected thereto and the connections they carry are interrupted.

In current communications systems, the central control unit transmits control commands solely to the active interface module, and the active interface module communicates the control commands to the redundant interface module using a communications channel. The active interface module is notified of the receipt of the respective control commands by the redundant interface module. In addition, the active interface module notifies the central control unit of receipt of the control commands only once the control commands have been acknowledged by the redundant interface module. As a consequence, each control command is processed twice by the active interface module during connection establishment or clearing, resulting in a considerable additional dynamic load on the interface module.

An object of the present invention, therefore, is to reduce the dynamic load of interface modules, which can be specified as active and/or redundant, in an ATM communications device.

SUMMARY OF THE INVENTION

Accordingly, the method of the present invention transmits the control commands, provided for the establishment and clearing of at least one virtual connection approximately simultaneously from the central control unit to the active and the redundant interface module, and the central control unit is not notified by the redundant interface module of receipt of the control commands. The approximately simultaneous transmission of the control commands to the active and redundant interface module dispenses with the need for direct communication between the active and redundant module, and performance is improved as a result of shorter connection establishment and clearing times. Furthermore, the load on the communications

channels provided for the exchange of information between the active and redundant interface module is dynamically relieved, and communication capacities of the communications channel are consequently available for additional applications.

Additional features and advantages of the present invention are described in, and will be apparent from, the following Detailed Description of the Preferred Embodiments and the Drawings.

DESCRIPTION OF THE DRAWINGS

Figure 1 shows a block circuit diagram of an ATM communications device to which the method of the present invention is directed.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG 1 shows an ATM communications device KE which operates using the asynchronous transfer mode and which enables the transmission of ATM cells over virtual connections. The ATM communications device KE has a central switching network ASN which has a central switching arrangement ASN-C (ASN core) and at least one ATM multiplexing device AMX connected to the switching arrangement ASN-C.

Connected to the central switching network ASN, specifically to the central switching arrangement ASN-C, via an ATM multiplexing device AMX is an associated central control unit MP, which is provided inter alia for the establishment of virtual connections. In the present exemplary embodiment, a number of interface modules LIC_akt, ..., LIC_red are also connected, for example via bidirectional connections, to the central switching network ASN via an ATM multiplexing device AMX, with the interface modules LIC_akt, ..., LIC_red being provided, in each case, for the connection of at least one of a number of peripheral transmission lines AL_akt, ..., AL_red. The transmission lines AL_akt, ..., AL_red are moreover designed for a bidirectional transmission of ATM cells.

The interface modules LIC_akt, ..., LIC_red are connected via an associated communications channel KK to the central control unit MP, and control commands sb are transmitted from the central control unit MP to the interface modules LIC_akt, ..., LIC_red via the communications channel KK.

The present exemplary embodiment shows an ATM communications device KE having "1+1" interface module redundancy, in which one active and one redundant interface module LIC_akt, LIC_red are operated in parallel; that is, the same connection data are transmitted over the redundant interface module LIC_red as over the associated active interface module LIC_akt. FIG 1 shows one active and one redundant interface module by way of example. However, only one of the two ATM cell streams are used for the further processing of the virtual connection. Each interface module LIC_akt, ..., LIC_red also has a module-specific control unit PCP which receives control commands sb from the central control unit MP over the communications channel KK.

According to the present invention, the control commands sb provided for the establishment and clearing of a virtual connection are transmitted approximately simultaneously from the central control unit MP to the active and redundant interface module LIC_akt, LIC_red over the communications channel KK, and the central control unit MP is not notified by the redundant interface module LIC_red of receipt of the control commands sb. In contrast, the active interface module LIC_akt notifies the central control unit MP of receipt of the control command sb over the communications channel KK using an "Acknowledge" message ak.

The approximately simultaneous transmission of the control commands sb to the active and redundant interface module LIC_akt, LIC_red ensures that both interface modules LIC_akt, LIC_red are driven approximately simultaneously into the same operating state, and it is consequently possible to switch over to the functioning, redundant interface module LIC_red within a very short period of time if the active interface module LIC_akt fails.

Application of the method according to the present invention is not restricted to "1+1" interface module redundancy, but can be used with different redundancy concepts employed in ATM communications devices KE. This includes both interface module redundancy and transmission link redundancy.

Indeed, although the present invention has been described with reference to specific embodiments, those of skill in the art will recognize that changes may be

made thereto without departing from the spirit and scope of the invention as set forth in the hereafter appended claims.

ABSTRACT OF THE DISCLOSURE

A method for operating interface modules in an ATM communications device wherein interface modules which can be specified as active and/or redundant are connected to a central control unit. Control commands provided for this purpose are transmitted approximately simultaneously from the central control unit to the active and the redundant interface module during the establishment and clearing of at least one virtual connection, and the redundant interface module does not acknowledge receipt of the control commands. The load on the interface module is thus dynamically relieved.

In the Claims:

On page 7, cancel line 1, and substitute the following left-hand justified head therefor:

We Claim as Our Invention:

Please cancel claims 1-3, without prejudice, and substitute the following claims therefor:

4. A method for operating interface modules in an ATM communications device, wherein each of the interface modules is specified as one of active and redundant, and wherein the interface modules are connected to a central control unit, the method comprising the steps of:

providing control commands for establishment and clearing of at least one virtual connection; and

transmitting the control commands approximately simultaneously from the central control unit to the active and the redundant interface modules;

wherein the central control unit is not notified by the redundant interface modules of respective receipt of the control commands.

5. A method for operating interface modules in an ATM communications device as claimed in claim 4, wherein no additional synchronization of the redundant and active interface modules is performed.

6. A method for operating interface modules in an ATM communications device as claimed in claim 4, wherein the procedures provided for controlling the active and redundant interface modules are processed approximately concurrently.

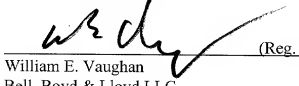
REMARKS

The present amendment makes editorial changes and corrects typographical errors in the specification, which includes the Abstract, in order to conform the specification to the requirements of United States Patent Practice. No new matter is added thereby. Attached hereto is a marked-up version of the changes made to the specification by the present amendment. The attached page is captioned "**Version With Markings To Show Changes Made**".

In addition, the present amendment cancels original claims 1-3 in favor of new claims 4-6. Claims 4-6 have been presented solely because the revisions by red-lining and underlining which would have been necessary in claims 1-3 in order to present those claims in accordance with preferred United States Patent Practice would have been too extensive, and thus would have been too burdensome. The present amendment is intended for clarification purposes only and not for substantial reasons related to patentability pursuant to 35 USC §§103, 102, 103 or 112. Indeed, the cancellation of claims 1-3 does not constitute an intent on the part of the Applicants to surrender any of the subject matter of claims 1-3.

Early consideration on the merits is respectfully requested.

Respectfully submitted,



(Reg. No. 39,056)

William E. Vaughan
Bell, Boyd & Lloyd LLC
P.O. Box 1135
Chicago, Illinois 60690-1135
(312) 807-4292
Attorneys for Applicants

VERSIONS WITH MARKINGS TO SHOW CHANGES MADE

In The Specification:

The Specification of the present application, including the Abstract, has been amended as follows:

S P E C I F I C A T I O N

TITLE

~~**Method for operating interface modules in an ATM communications device**~~

METHOD FOR OPERATING INTERFACE MODULES IN AN ATM COMMUNICATIONS DEVICE

BACKGROUND OF THE INVENTION

~~Description~~

Field of the Invention

The present invention relates to a method for operating interface modules, which can be specified as active and/or redundant, in an ATM communications device, in which the interface modules, which can be specified as active and/or redundant, are connected to a central control unit.

Description of the Prior Art

In communications devices, in particular communications devices that operate using the asynchronous transfer mode, virtual connections are often established, maintained and terminated via interface modules with the aid of a central control unit. The central control unit is used here, in particular, to transmit control commands to establish and clear virtual connections to the interface modules.

In order to ensure disruption-free operation and to enable rectification of errors in an active interface module, redundant interface modules and/or redundant transmission paths are provided. If one interface module or transmission path fails, the communications link, in particular a virtual connection, is rerouted to a redundant interface module and/or transmission link. Depending on the level of fail-safety required for a communications device or transmission link, it is possible to provide different redundancy structures for the associated interface module. Examples of these are "1+1", "1:1" and "1:N" interface module redundancy, cf. in particular "IEEE

Journal on Selected Areas in Communications", VOL. 15, No. 5, June 1997, pages 795 to 806.

With a "1+1" redundancy structure, two interface modules are operated in parallel in order for communication signal streams to be transmitted via them redundantly. Of these communication signal streams transmitted redundantly, only one is used for the further processing of the virtual connection.

With "1:1" interface module redundancy, only one of two interface modules is used as the active interface module, with a switchover being made to the remaining redundant interface module only if the active interface module fails.

With "1:N" interface module redundancy, one redundant interface module is additionally provided for a ~~plurality~~ number N of interface modules. If an error occurs in one of the N interface modules, a switchover is then made to the redundant interface module instead.

With "1:N" interface module redundancy, a selector arrangement is usually connected between the interface modules and the external transmission lines; ~~said~~ the selector can allocate the individual transmission lines to the N interface modules and the redundant interface module. It should be noted however that if a selector arrangement fails, or in the event of ~~said~~ the selector arrangement being consequently exchanged, all transmission lines connected thereto and the connections they carry are interrupted.

In current communications systems, the central control unit transmits control commands solely to the active interface module, and the active interface module communicates the control commands to the redundant interface module using a communications channel. The active interface module is notified of the receipt of the respective control commands by the redundant interface module. In addition, the active interface module notifies the central control unit of receipt of the control commands only once the control commands have been acknowledged by the redundant interface module. As a consequence, each control command is processed twice by the active interface module during connection establishment or clearing, resulting in a considerable additional dynamic load on the interface module.

~~The~~ An object of the present invention, therefore, is to reduce the dynamic load of interface modules, which can be specified as active and/or redundant, in an ATM communications device. ~~Starting from a method according to the features set out in the preamble of patent claim 1, this object is achieved by the feature set out in the defining part.~~

SUMMARY OF THE INVENTION

~~The essential aspect of~~ Accordingly, the method ~~according to~~ of the present invention ~~is that~~ transmits the control commands, provided for the establishment and clearing of at least one virtual connection, ~~are transmitted~~ approximately simultaneously from the central control unit to the active and the redundant interface module, and the central control unit is not notified by the redundant interface module of receipt of the control commands. The approximately simultaneous transmission of the control commands to the active and redundant interface module dispenses with the need for direct communication between the active and redundant module, and performance is improved as a result of shorter connection establishment and clearing times. Furthermore, the load on the communications channels provided for the exchange of information between the active and redundant interface module is dynamically relieved, and communication capacities of the communications channel are consequently available for additional applications.

Additional features and advantages of the present invention are described in, and will be apparent from, the following Detailed Description of the Preferred Embodiments and the Drawings.

~~Additional advantageous refinements of the method according to the invention emerge from the further claims.~~

DESCRIPTION OF THE DRAWINGS

Figure 1 shows a block circuit diagram of an ATM communications device to which the method of the present invention is directed.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

~~The method according to the invention is explained in greater detail below with reference to a block circuit diagram in which only the elements of an ATM~~

~~communications device KE which are required to understand the present invention are represented.~~

FIG 1 shows an ATM communications device KE which operates using the asynchronous transfer mode and which enables the transmission of ATM cells over virtual connections. The ATM communications device KE has a central switching network ASN which has a central switching arrangement ASN-C (ASN core) and at least one ATM multiplexing device AMX connected to the switching arrangement ASN-C.

Connected to the central switching network ASN, specifically to the central switching arrangement ASN-C, via an ATM multiplexing device AMX is an associated central control unit MP, which is provided inter alia for the establishment of virtual connections. In the present exemplary embodiment, a ~~plurality~~ number of interface modules LIC_akt, ..., LIC_red are also connected, for example ~~by means of~~ via bidirectional connections, to the central switching network ASN via an ATM multiplexing device AMX, with the interface modules LIC_akt, ..., LIC_red being provided, in each case, for the connection of at least one of a ~~plurality~~ number of peripheral transmission lines AL_akt, ..., AL_red. ~~Said~~ The transmission lines AL_akt, ..., AL_red are moreover designed for a bidirectional transmission of ATM cells.

The interface modules LIC_akt, ..., LIC_red are connected via an associated communications channel KK to the central control unit MP, and control commands sb are transmitted from the central control unit MP to the interface modules LIC_akt, ..., LIC_red ~~by means of~~ via the communications channel KK.

The present exemplary embodiment shows an ATM communications device KE having "1+1" interface module redundancy, in which one active and one redundant interface module LIC_akt, LIC_red are operated in parallel~~;~~, that is, ~~to say~~ the same connection data are transmitted over the redundant interface module LIC_red as over the associated active interface module LIC_akt. FIG 1 shows one active and one redundant interface module by way of example. However, only one of the two ATM cell streams are used for the further processing of the virtual connection. Each interface

module LIC_akt, ..., LIC_red also has a module-specific control unit PCP which receives control commands sb from the central control unit MP over the communications channel KK.

According to the present invention, the control commands sb provided for the establishment and clearing of a virtual connection are transmitted approximately simultaneously from the central control unit MP to the active and redundant interface module LIC_akt, LIC_red over the communications channel KK, and the central control unit MP is not notified by the redundant interface module LIC_red of receipt of the control commands sb. In contrast, the active interface module LIC_akt notifies the central control unit MP of receipt of the control command sb over the communications channel KK using an "Acknowledge" message ak.

The approximately simultaneous transmission of the control commands sb to the active and redundant interface module LIC_akt, LIC_red ensures that both interface modules LIC_akt, LIC_red are driven approximately simultaneously into the same operating state, and it is consequently possible to switch over to the functioning, redundant interface module LIC_red within a very short ~~space~~ period of time if the active interface module LIC_akt fails.

Application of the method according to the present invention is not restricted to "1+1" interface module redundancy, but can be used with different redundancy concepts employed in ATM communications devices KE. This includes both interface module redundancy and transmission link redundancy.

Indeed, although the present invention has been described with reference to specific embodiments, those of skill in the art will recognize that changes may be made thereto without departing from the spirit and scope of the invention as set forth in the hereafter appended claims.

~~Abstract~~

ABSTRACT OF THE DISCLOSURE

~~Method for operating interface modules in an ATM communications device~~

A method for operating interface modules in an ATM communications device wherein interface ~~Interface~~ modules ~~(LIC_akt, ..., LIC_red)~~ which can be specified as active and/or redundant are connected to a central control unit ~~(MP)~~. Control commands ~~(sb)~~ provided for ~~the~~ this purpose are transmitted approximately simultaneously from the central control unit ~~(MP)~~ to the active and the redundant interface module ~~(LIC_akt, ..., LIC_red)~~ during the establishment and clearing of at least one virtual connection, and the redundant interface module ~~(LIC_red)~~ does not acknowledge receipt of the control commands ~~(sb)~~. The load on the interface module ~~(LIC_akt)~~ is thus dynamically relieved.

~~Figure 1~~

Description

Method for operating interface modules in an ATM communications device

The invention relates to a method for operating interface modules, which can be specified as active and/or redundant, in an ATM communications device, in which the interface modules, which can be specified as active and/or redundant, are connected to a central control unit.

In communications devices, in particular communications devices that operate using the asynchronous transfer mode, virtual connections are often established, maintained and terminated via interface modules with the aid of a central control unit. The central control unit is used here in particular to transmit control commands to establish and clear virtual connections to the interface modules.

In order to ensure disruption-free operation and to enable rectification of errors in an active interface module, redundant interface modules and/or redundant transmission paths are provided. If one interface module or transmission path fails, the communications link, in particular a virtual connection, is rerouted to a redundant interface module and/or transmission link. Depending on the level of fail-safety required for a communications device or transmission link, it is possible to provide different redundancy structures for the associated interface module. Examples of these are "1+1", "1:1" and "1:N" interface module redundancy, cf. in particular "IEEE Journal on Selected Areas in Communications", VOL. 15, No. 5, June 1997, pages 795 to 806.

With a "1+1" redundancy structure, two interface modules are operated in parallel in order for communication signal streams to be transmitted via them redundantly. Of these communication signal streams transmitted redundantly, only one is used for the further processing of the virtual connection.

With "1:1" interface module redundancy, only one of two interface modules is used as the active interface module, with a switchover being made to the remaining redundant interface module only if the active interface module fails.

With "1:N" interface module redundancy, one redundant interface module is additionally provided for a plurality N of interface modules. If an error occurs in one of the N interface modules, a switchover is then made to the redundant interface module instead.

With "1:N" interface module redundancy, a selector arrangement is usually connected between the interface modules and the external transmission lines; said selector can allocate the individual transmission lines to the N interface modules and the redundant interface module. It should be noted however that if a selector arrangement fails, or in the event of said selector arrangement being consequently exchanged, all transmission lines connected thereto and the connections they carry are interrupted.

In current communications systems, the central control unit transmits control commands solely to the active interface module, and the active interface module communicates the control commands to the redundant interface module using a communications channel. The active interface module is notified of the receipt of the respective control commands by the

redundant interface module. In addition, the active interface module notifies the central control unit of receipt of the control commands only once the control commands have been acknowledged by the redundant interface module. As a consequence, each control command is processed twice by the active interface module during connection establishment or clearing, resulting in a considerable additional dynamic load on the interface module.

The object of the invention is to reduce the dynamic load of interface modules, which can be specified as active and/or redundant, in an ATM communications device. Starting from a method according to the features set out in the preamble of patent claim 1, this object is achieved by the feature set out in the defining part.

The essential aspect of the method according to the invention is that the control commands provided for the establishment and clearing of at least one virtual connection are transmitted approximately simultaneously from the central control unit to the active and the redundant interface module, and the central control unit is not notified by the redundant interface module of receipt of the control commands. The approximately simultaneous transmission of the control commands to the active and redundant interface module dispenses with the need for direct communication between the active and redundant module, and performance is improved as a result of shorter connection establishment and clearing times. Furthermore, the load on the communications channels provided for the exchange of information between the active and redundant interface module is dynamically relieved, and communication capacities of the communications channel are consequently available for additional applications.

Additional advantageous refinements of the method according to the invention emerge from the further claims.

The method according to the invention is explained in greater detail below with reference to a block circuit diagram in which only the elements of an ATM communications device KE which are required to understand the present invention are represented.

FIG 1 shows an ATM communications device KE which operates using the asynchronous transfer mode and which enables the transmission of ATM cells over virtual connections. The ATM communications device KE has a central switching network ASN which has a central switching arrangement ASN-C (ASN core) and at least one ATM multiplexing device AMX connected to the switching arrangement ASN-C.

Connected to the central switching network ASN, specifically to the central switching arrangement ASN-C, via an ATM multiplexing device AMX is an associated central control unit MP, which is provided inter alia for the establishment of virtual connections. In the present exemplary embodiment, a plurality of interface modules LIC_akt, ..., LIC_red are also connected, for example by means of bidirectional connections, to the central switching network ASN via an ATM multiplexing device AMX, with the interface modules LIC_akt, ..., LIC_red being provided in each case for the connection of at least one of a plurality of peripheral transmission lines AL_akt, ..., AL_red. Said transmission lines AL_akt, ..., AL_red are moreover designed for a bidirectional transmission of ATM cells.

The interface modules LIC_akt, ..., LIC_red are connected via an associated communications channel KK to the central control unit MP, and control commands sb are transmitted from the central control unit MP to the interface modules LIC_akt, ..., LIC_red by means of the communications channel KK.

The present exemplary embodiment shows an ATM communications device KE having "1+1" interface module redundancy, in which one active and one redundant interface module LIC_akt, LIC_red are operated in parallel, that is to say the same connection data are transmitted over the redundant interface module LIC_red as over the associated active interface module LIC_akt. FIG 1 shows one active and one redundant interface module by way of example. However, only one of the two ATM cell streams are used for the further processing of the virtual connection. Each interface module LIC_akt, …, LIC_red also has a module-specific control unit PCP which receives control commands sb from the central control unit MP over the communications channel KK.

According to the invention, the control commands sb provided for the establishment and clearing of a virtual connection are transmitted approximately simultaneously from the central control unit MP to the active and redundant interface module LIC_akt, LIC_red over the communications channel KK, and the central control unit MP is not notified by the redundant interface module LIC_red of receipt of the control commands sb. In contrast, the active interface module LIC_akt notifies the central control unit MP of receipt of the control command sb over the communications channel KK using an "Acknowledge" message ak.

The approximately simultaneous transmission of the control commands sb to the active and redundant interface module LIC_akt, LIC_red ensures that both interface modules LIC_akt, LIC_red are driven approximately simultaneously into the same operating state, and it is consequently possible to switch over to the functioning, redundant interface module LIC_red within a very short space of time if the active interface module LIC_akt fails.

Application of the method according to the invention is not restricted to "1+1" interface module redundancy, but can be used with different redundancy concepts employed in ATM communications devices KE. This includes both interface module redundancy and transmission link redundancy.

Patent claims

1. A method for operating interface modules (LIC_akt, …, LIC_red), which can be specified as active and/or redundant, in an ATM communications device (KE), in which the interface modules (LIC_akt, …, LIC_red), which can be specified as active and/or redundant, are connected to a central control unit (MP), characterized in that the control commands (sb) provided for the establishment and clearing of at least one virtual connection are transmitted approximately simultaneously from the central control unit (MP) to the active and the redundant interface module (LIC_akt, …, LIC_red), and the central control unit (MP) is not notified by the redundant interface module (LIC_red) of receipt of the control commands (sb).

2. The method as claimed in claim 1, characterized in that no additional synchronization of the redundant and active interface module (LIC_akt, …, LIC_red) is performed.

3. The method as claimed in claim 1 or 2, characterized in that the procedures provided for controlling the active and redundant interface module (LIC_akt, …, LIC_red) are processed approximately concurrently.

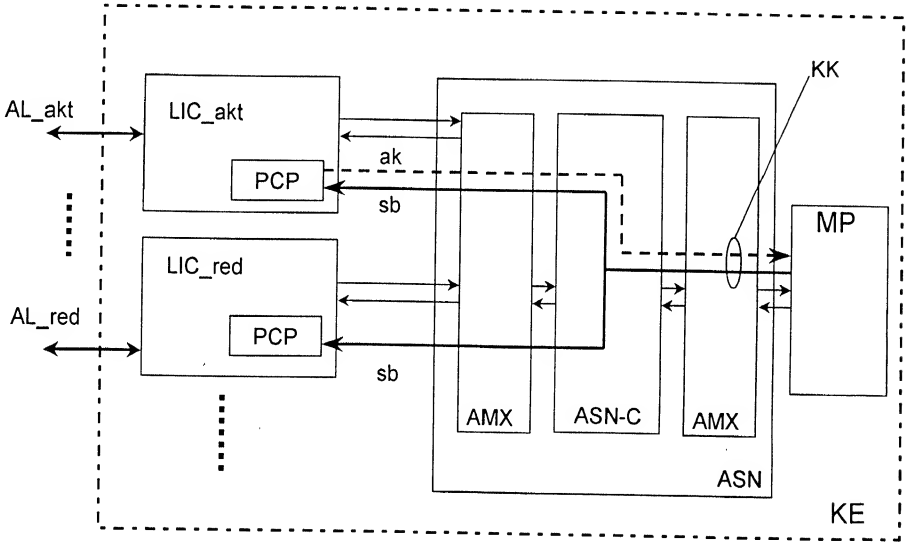
Abstract

Method for operating interface modules in an ATM communications device

Interface modules (LIC_akt, …, LIC_red) which can be specified as active and/or redundant are connected to a central control unit (MP). Control commands (sb) provided for the purpose are transmitted approximately simultaneously from the central control unit (MP) to the active and the redundant interface module (LIC_akt, …, LIC_red) during the establishment and clearing of at least one virtual connection, and the redundant interface module (LIC_red) does not acknowledge receipt of the control commands (sb). The load on the interface module (LIC_akt) is thus dynamically relieved.

Figure 1

FIG 1



Declaration and Power of Attorney For Patent Application
Erklärung Für Patentanmeldungen Mit Vollmacht
German Language Declaration

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt:

As a below named inventor, I hereby declare that:

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My residence, post office address and citizenship are as stated below next to my name,

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I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Verfahren zum Betreiben von Peripheriebaugruppen innerhalb einer ATM-Kommunikationseinrichtung

deren Beschreibung

(zutreffendes ankreuzen)

☒ hier beigefügt ist.

☒ am _____ als PCT internationale Anmeldung PCT Anmeldungsnummer _____ eingereicht wurde und am _____ abgeändert wurde (falls tatsächlich abgeändert).

the specification of which

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I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above.

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I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

Ich beanspruche hiermit ausländische Prioritätsvorteile gemäss Abschnitt 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 119 aller unten angegebenen Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde, und habe auch alle Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde nachstehend gekennzeichnet, die ein Anmeldedatum haben, das vor dem Anmeldedatum der Anmeldung liegt, für die Priorität beansprucht wird.

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Prior foreign applications
Priorität beansprucht

(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Priority Claimed Yes Ja	No Nein
198 56 835.5	Germany	09. Dezember 1998	☒	☐
			☐	☐
			☐	☐

Ich beanspruche hiermit gemäss Absatz 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 120, den Vorzug aller unten aufgeführten Anmeldungen und falls der Gegenstand aus jedem Anspruch dieser Anmeldung nicht in einer früheren amerikanischen Patentanmeldung laut dem ersten Paragraphen des Absatzes 35 der Zivilprozeßordnung der Vereinigten Staaten, Paragraph 122 offenbart ist, erkenne ich gemäss Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) meine Pflicht zur Offenbarung von Informationen an, die zwischen dem Anmeldedatum der früheren Anmeldung und dem nationalen oder PCT internationalen Anmeldedatum dieser Anmeldung bekannt geworden sind.

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(Application Serial No.) (Anmeldeserienummer)	(Filing Date) (Anmeldedatum)	(Status) (patentiert, anhängig, aufgegeben)	(Status) (patented, pending, abandoned)

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POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

And I hereby appoint

Messrs. William E. Vaughan (Reg. No. 39,056); Robert M. Barrett (Reg. No. 30,142); Michael S. Leonard (Reg. No. 37,557); Patricia A. Kane (Reg. No. 46,446); Thomas C. Basso (Reg. No. P46,541); Robert W. Connors (Reg. No. P46,442); Troy A. Groetren (Reg. No. 46,442); Adam H. Masia (Reg. No. 35,602); Dante J. Picciano (Reg. No. 33,543); Amy J. Gast (Reg. No. 41,773); Timothy L. Harney (Reg. No. 38,174); Renato L. Smith (Reg. No. 45,117); and Alan L. Barry (Reg. No. 30,819)

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Telefongespräche bitte richten an: *(Name und Telefonnummer)*

Direct Telephone Calls to: *(name and telephone number)*

(312) 807-4292
Ext. _____

Postanschrift:

Send Correspondence to:

William E. Vaughan
Bell, Boyd & Lloyd
P.O. Box 1135
Chicago, IL 60690-1135

1-01

Voller Name des einzigen oder ursprünglichen Erfinders:	Full name of sole or first inventor.
KÖPP, Jörg	
Unterschrift des Erfinders / Datum: 30.01.01	Inventor's signature / Date
Wohnsitz: D- 81476 München, Germany (DE)	Residence
Staatsangehörigkeit: Bundesrepublik Deutschland	Citizenship
Postanschrift: Liesl-Karlstadt-Str. 15 D-81476 München Bundesrepublik Deutschland	Post Office Addess

2-01

Voller Name des zweiten Miterfinders (falls zutreffend):	Full name of second joint inventor, if any:
STELZL, Rudolf	
Unterschrift des Erfinders / Datum: 25.1.01	Second Inventor's signature / Date
Wohnsitz: D-85221 Dachau, Germany (DE)	Residence
Staatsangehörigkeit: Bundesrepublik Deutschland	Citizenship
Postanschrift: Pfarrer Lechner Weg 4 D-85221 Dachau Bundesrepublik Deutschland	Post Office Address

(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben).

(Supply similar information and signature for third and subsequent joint inventors).